

C. Remarks

Turning first to the matters of language raised in the office action, claims 1 and 15 have been amended to clarify the matters noted by the Examiner. Additionally claims 10-15 have been amended to more accurately recite that it is the separated solids that are heat treated. It is believed that these amendments are sufficient to remove the objections and rejections to the claims.

In the office action, claims 1-19 were rejected under 35 U.S.C. 102(e)/103(a) as being unpatentable over Yamawaki et al in view of Marsh et al. In order to more clearly define, and distinctly claim, the present invention from that of the prior art, independent claims 1 and 18 have been amended to recite that the particles are composed of crystals that are less than 100 nm in size. These properties are not provided by Yamawaki, when taken alone or in combination with the Marsh reference.

The present invention set forth in claim 1, as amended, is directed to a process for producing nanostructured $\text{Li}_4\text{Ti}_5\text{O}_{12}$ particles, having the steps of: dissolving a lithium containing salt in an organic solvent to form a liquid solution, a dispersion of nanoparticles of TiO_2 is then added to the liquid solution, the TiO_2 nanoparticles having an average

primary particle size of less than 100 nm, the liquid solution is heated to facilitate diffusion of lithium ions into the nanoparticles; the solids are separated from the liquid solution; and the solids are thereafter heat treated to form the nanostructured $\text{Li}_4\text{Ti}_5\text{O}_{12}$ particles. Claim 18 is directed to the nanostructured $\text{Li}_4\text{Ti}_5\text{O}_{12}$ per se.

Turning now to the references cited in the office action, the patent to Yamawaki is directed to a dry sintering process for producing lithium titanate particles ranging from 100 nm and up, more preferably much larger than 100 nm. Generally such particles of greater than 100nm are referred to as micron sized. The present process is directed to the production of particles composed of crystals that are 100nm and down, i.e. nano-sized as the term is used in the art. The process used by Yamawaki is completely different from that of the present claims. Yamawaki uses a process in which a mixture of TiO_2 and lithium compound is heat treated at least at 600 °C to form a composition comprising TiO_2 and $\text{Li}_x\text{Ti}_y\text{O}_z$. The formation of $\text{Li}_x\text{Ti}_y\text{O}_z$ occurs in the solid state and not in the liquid state. It is to be noted that Yamawaki forms $\text{Li}_4\text{Ti}_5\text{O}_{12}$ by a sintering process, wherein a powder compact is subjected to heat treatment. As a result, the product is a compact (which must be crushed and screened-see col. 4 lines 14-18 of Yamawaki) rather than a loose powder, which is the product of the present invention. Therefore, the present invention is not *prima facie* obvious from the Yamawaki et al's patent for those who are skilled in the art to which said subject matter pertains.

Furthermore as it is clear that Yamawaki desires to produce micron sized particles as 100nm is the ultimate lower limit for his particles with the preferred range being 300 to

10000nm (0.3 to 10 microns) and the more preferred range of Yamawaki is 500 to 5000 nm (0.5 to 5 microns), as described at col. 4 lines 15-21 of Yamawaki. It is thus seen that Yamawaki in fact "teaches away" from the nano sized $\text{Li}_4\text{Ti}_5\text{O}_{12}$ of the present invention. Such a teaching away by the prior art is a hallmark of a non-obvious invention.

The claims have also been rejected as obvious over Yamawaki in view of Marsh, this rejection is respectfully traversed. It was said in the office action that it would be obvious to combine the dry process of Yamawaki with the wet process of Marsh so as to render the present process obvious. While Marsh is directed to a wet process for making metal oxides, there is no suggestion that it is combinable with a dry process and no suggestion that it is useable for the nanostructured material herein. It is to combine apples and oranges to combine the totally disparate processes of Yamawaki and Marsh. Such a combination can only be the result of improper hindsight and as such is not a proper ground for a conclusion as to obviousness. Furthermore, while Marsh uses an organic solvent to dissolve organic precursors of all the constituents to form a homogeneous solution, the solution is hydrolyzed with water to promote the particle-formation. The present process, on the contrary, requires the amount of water to be minimized because the hydration layer of dopant cations will reduce their diffusion rate into the host oxide nanoparticles. Thus the process of Marsh is not suitable for use in the present invention.

Another distinguishing feature between Marsh's process and the present invention is that the starting feed materials are completely dissolved in a solution in case of Marsh, whereas it is a combination of a solution and a dispersion of solid nanoparticles in case of

the present invention. Marsh's process does not involve any diffusion of cationic species into a host particle, which is precisely what happens in the present invention.

In summary, the differences between the invention defined in the claims as amended and Yamawaki are manifest:

- 1) Different starting materials- The present application uses Nano sized (less than 100nm) TiO_2 particles while Yamawaki uses 100 nm and up, most preferably much larger micron sized particles
- 2) Different processes: the present process is a liquid process. It is not a dry process requiring subsequent grinding as in Yamawaki.
- 3) Different end product: the present invention produces Nanosized $\text{Li}_4\text{Ti}_5\text{O}_{12}$ particles not micron sized particles as in Yamawaki
- 4) Finally the present invention yields a superior battery material, Nanostructured $\text{Li}_4\text{Ti}_5\text{O}_{12}$ particles provide superior battery performance than the non- Nanostructured particles of Yamawaki.

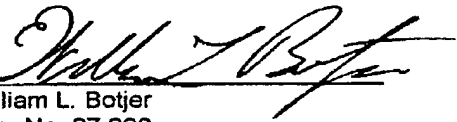
The Marsh patent adds nothing to this analysis as it is clear that the liquid process of Marsh cannot be logically combined with the dry sintering process of Yamawaki. It is clear that the invention defined in the present claims as amended is neither anticipated, nor rendered obvious over, by the prior art.

The present claims have been amended to highlight the distinctions of the present invention over the prior art and it is respectfully submitted that the claims are now clearly patentable over the art of record, and notice to that effect is earnestly solicited, If the

Examiner has any questions regarding this matter, the Examiner is requested to telephone applicants attorney at the numbers listed below prior to issuing a further action.

Respectfully Submitted,

Dated: October 2, 2003

By 
William L. Botjer
Reg. No. 27,990
PO Box 478
Center Moriches, NY 11934
(212) 737-5728 (Tue-Thurs)
(631) 874-4826 (Mon & Fri)

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